



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

09/912,103

07/23/2001

Huong Thanh Nguyen

5619/DD/LOW K/JW

4476

32588

7590

02/14/2003

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER

NGUYEN, KHIEM D

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 02/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/912,103

Applicant(s)

NGUYEN ET AL.

Examiner

Khiem D Nguyen

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 8.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings

The corrected or substitute drawings were received on 11-18-2002. These drawings are accepted by the examiner.

Response to Amendment

Applicant's arguments filed 11-18-2002 have been fully considered but they are not persuasive.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
2. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flanner et al. (U.S. Patent 6,410,437) in view of Twu et al. (U.S. Patent 6,417,106) and Nakane et al. (U.S. Patent 4,401,745).

Flanner teaches a method of fabricating a damascene structure, comprising (See col. 4, line 9 to col. 8, line 28 and FIGS. 3-21):

Note that, the second organosilicate layer 12 of Flanner is corresponding to the first organosilicate layer 405 in the claims of this invention and the first organosilicate layer 8 of Flanner is corresponding to the second organosilicate layer 408.

(a) forming a barrier layer 14 on a substrate 16 having a metal layer (electrically conductive element) 18 thereon;

- (b) forming a second organosilicate layer 12 on the barrier layer;
- (c) forming an etch stop layer 10 on the second organosilicate layer;
- (d) forming a first organosilicate layer 8 on the etch stop layer; and
- (e) etching the first organosilicate layer to define vias therein, wherein the organosilicate layer is etched with a hydrogen-containing fluorocarbon gas mixture includes one or more gases selected from the group consisting of trifluoromethane (CHF_3) and carbon tetrafluoride (CF_4) and further includes one or more gasses selected from the group consisting of nitrogen (N_2) and oxygen (O_2);
- (f) etching the etch stop layer to transfer the vias defined in the first organosilicate layer therethrough;
- (g) patterning the first organosilicate layer to define interconnects therethrough, wherein the interconnects are positioned over the vias, and wherein the via pattern is transferred through the second organosilicate layer when the interconnects are defined in the first organosilicate layer; and
- (g) filling the vias and interconnects with a conductive material 42 selected from the group of copper (Cu).

Flanner teaches that the etch stop layer is made of silicon nitride but fails to teach that the etch stop layer 12 is made of silicon oxide as recited in present claim 1.

Twu teaches a process for forming a damascene structure wherein an etch stop layer can be made of silicon oxide, silicon oxynitride or silicon nitride. See col. 3, lines 11-30. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Twu's teaching into Flanner's method to formed

the etch stop layer using silicon oxide because in doing so a damascene structure can be formed in a dielectric layer of low dielectric constant. See col. 2, lines 40-41.

Flanner fails to teaches that the first organosilicate layer and the silicon oxide layer are etched at a temperature within the range of about -20°C to about 80°C and are etched at a pressure within a range of about 5mtorr to about 1 torr and further comprising applying an electric field (radio frequency (RF) power) to the hydrogen-containing fluorocarbon gas mixture selected from the group consisting of carbon tetrafluoride (CF_4) and fluorothane (C_2F_6) and includes one or more gases selected from the group consisting of hydrogen (H_2), nitrogen (N_2), oxygen (O_2), argon (Ar), and helium (He) wherein the RF power is within a range of about $1\text{ watt}/\text{cm}^2$ to about $100\text{ watts}/\text{cm}^2$ as recited in present claims 8-20.

Nakane teaches etching the silicon oxide layer at a temperature of 100°C and at a gas pressure of 0.6 torr under the condition of applying a radio frequency (RF) power of 100 watts to the hydrogen-containing fluorocarbon gas mixture consisting of carbon tetrafluoride (CF_4) and further includes oxygen (O_2). See col. 10, lines 54-61. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Nakane's teaching into Flanner's method because in doing so an etching pattern faithful to a resist patter can be obtained. See col. 10, lines 54-61.

Response to Applicant's Arguments

Applicant's arguments filed 11-18-2002 have been fully considered but they are not persuasive.

In response to Applicant's argument that Nakane et al., Flanner et al., and Twu et al., either alone or in combination do teach, show, or suggest forming a silicon oxide layer, forming an organosilicate layer on the silicon oxide layer, and etching the second organosilicate layer to define vias therein, wherein the second organosilicate layer is etched with a hydrogen-containing fluorocarbon gas mixture, Flanner et al. discloses forming a silicon oxide layer 10 (col. 5, lines 2-3), forming an organosilicate layer 8 on the silicon oxide layer, and etching the second organosilicate layer to define vias therein, wherein the second organosilicate layer is etched with a hydrogen-containing fluorocarbon gas mixture (col. 6, lines 61-62 and FIGS. 1-22). The Twu and Nakane references only used as a secondary references to further disclose other limitations of the present application.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


Art Unit: 2823

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
February 12, 2003


George Fourson
Primary Examiner
2823